Cultural dimensions of climate change impacts and adaptation

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Society's response to every dimension of global climate change is mediated by culture. We analyse new research across the social sciences to show that climate change threatens cultural dimensions of lives and livelihoods that include the material and lived aspects of culture, identity, community cohesion and sense of place. We find, furthermore, that there are important cultural dimensions to how societies respond and adapt to climate-related risks. We demonstrate how culture mediates changes in the environment and changes in societies, and we elucidate shortcomings in contemporary adaptation policy.

Responding to climate change is about adjusting to risks, either in reaction to or in anticipation of changes arising from changing weather and climate. Research and policy on adaptation and mitigation has largely focused on the material aspects of climate change, including risks to lives and livelihoods, the costs of decarbonizing economies and the costs of impacts on various sectors of the economy[1]. These are, for the most part, quantifiable and therefore conventionally included in policy analyses. No less important, however, are the cultural dimensions of climate change.

Culture is important for understanding both mitigation of and adaptation to climate change, and of course plays its part in framing climate change as a phenomenon of concern to society. Culture is embedded in the dominant modes of production, consumption, lifestyles and social organization that give rise to emissions of greenhouse gases. The consequences of these emissions—climate change impacts—are given meaning through cultural interpretations of science and risk[2–4]. Culture is no less central to understanding and implementing adaptation: the identification of risks, decisions about responses, and means of implementation are all mediated by culture. Cultures are dynamic and reflexive and so are in turn shaped by the idea of climate change. Hence culture, and its analysis, is central to understanding the causes and meaning of, and human responses to climate change.

Here we focus on weather and climate-related risks and the cultural dimensions of adaptation responses, while recognizing that culture plays an equally central role in energy, technology and mitigation. Our scope is restricted to cultural aspects of risks and adaptation, and in particular the non-material processes and resources that enable people to lead meaningful and dignified lives, yet which are at risk from climate change. We analyse the evidence from a wave of new social science research into these hitherto under-emphasized cultural dimensions of climate change risks and responses, and suggest how they might inform adaptation planning. This recent body of work shows that climate change exacerbates risks to cultures; that most contemporary responses fail to address these critical dimensions of climate risk; that climate change adaptation can itself put some of these important elements of social life at risk; and that these elements may in turn be enablers or barriers to adaptation.

Climate change and cultural change

Culture is defined here as the symbols that express meaning, including beliefs, rituals, art and stories that create collective outlooks and behaviours, and from which strategies to respond to problems are devised and implemented[5,6]. It has both non-material and material aspects. Culture, in the way we examine it here, is often closely tied to places (physical spaces that are given meaning by people), even as both have become increasingly transnationalized through processes of globalization[7–9]. Thus, as culture and community are frequently rooted in place—from metropolitan areas through to marginal rural settlements—climate change impacts in these places may also change cultures and communities, often in ways that people find undesirable and perceive as loss[10].

Analyses of culture and place span disciplines from anthropology to geography and human ecology, and use a range of theories and methods. Cultural geographers, for example, suggest that production of culture is tied up with the construction of landscapes that "comprise all the physical, biological and cultural phenomena interacting in a region, exhibiting historical depth in the shape of the residues of antecedent landscapes"[11]. Alternatively, human ecology analyses social–ecological systems to discern interactions between social practices, values and change in the natural world[12]. In most cases, the methods for studying culture tend to be qualitative, frequently including ethnography and participant observation, and data from these methods do not sit comfortably with the quantitative approaches prevalent in other social and natural science on climate change. This is one reason why cultural aspects have not been well integrated into climate change analyses and policies.

The expected impacts of climate change will affect cultures in diverse ways (see Table 1). The risks are manifest globally: few cultures will escape the influences of climate change in these coming decades whether in cities in the developed world or in resource-dependent subsistence economies (Box 1 documents contemporary challenges on one Pacific island state). Cultural change is not a phenomenon of marginal societies: indeed post-materialist values in themselves are argued by some analyses to be those values most challenged by environmental change[13].

The changes that arise from climate change are only deemed negative within a given cultural frame of reference, making it difficult to predict which of the changes arising from climate

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Table 1 | Examples of climate effects and possible cultural and representational impacts.

Projected biological and physical impacts	Cultural impacts
Increased extent of areas affected by drought	Pastoralism as a cultural phenomenon under threat. Erosion of social structures as populations exit from herding[74,75].
Changes to availability or range of fish stocks and coral reefs	Loss of fish stocks leads to loss of symbolic value and cultural practices attached to particular species. An example is the 'place spirits' in sharks, rays and dolphins in Melanesia[76]. Cultural practices may not be adaptable to changes in fish population dynamics.
Decreased snow and ice cover in Arctic	Hunters and fishers forced to switch target fishing and hunting species and losing traditional knowledge and cultural identity such as traditional housing[77].
Retreat and loss of snow cover and glaciers at high altitudes	Loss of winter culture and recreation and the place of snow in ritual and sense of place; observed in Europe, North America and Australia[78,79]. In high latitudes pastoralist and other cultures such as the Quechua-speaking villagers in southern Peru sense dislocation from the natural world with retreat of the Quelccaya ice cap[80].
Ecosystem disturbance and plant and animal species at risk from localized or global extinction	Loss of iconic and culturally significant habitats such as those of the uplands of England associated with cultural expressions[81]. Changes to phenology and seasons in England leading to dislocation from place[81]. Loss of experienced weather patterns such as 'soft rain' in Ireland[82]. Threats to global icons such as snow cover on Kilimanjaro[83].

change will lead to losses of cultural assets that communities value. But some consequences are less ambiguous. The loss of access to places as a result of coastal inundation, for example, or even as a consequence of climate change adaptation or mitigation policies, will have clear impacts on culture. When people are displaced from places that they value, there is strong evidence that their cultures are diminished, and in many cases endangered. There are often no effective substitutions for, or adequate compensation for, lost sites of significance[10,14,15].

The importance of these impacts is closely correlated with the level of attachment that individuals experience around their settlement or place. Attachment to place is a concept that describes the level of connection that individuals have with the people and environments in which they live[16–18]. The concept, well established within sociology and geography, describes the identity created around a settlement or place, the sense of pride associated with belonging to a village, town or city, and the friendships and networks that exist within them[19,20]. It contributes to individual and community well-being and quality of life, and is widely used as an element in assessing community sustainability.

Place attachment is thus emerging as an important factor for climate adaptation in regions where existing livelihoods are unlikely to be maintained as the impacts of climate change are increasingly manifest[21–23]. Attachment to a place may be closely linked to a sense of belonging to a community[8]. Individuals with a strong attachment to their community are often unwilling to migrate to maintain their income levels because they are reluctant to leave behind their social and emotional support groups and adapt to a new community[24]. Box 2 on migration and resettlement shows that attachment to place is a critical factor in decisions about migration. Indeed, as has been recently argued in this journal, for its impacts on communities and cultures, wholesale resettlement of populations may often be maladaptive, and should be a strategy of last resort[25].

Individuals with a high level of place attachment can be distressed at the prospect of moving from their home communities. There is also strong evidence to suggest that control over whether and how change in location occurs is important for psychological and emotional well-being. Social scientists have explored the phenomenon of place attachment in various ways[26–28], but two are especially pertinent in the context of climate adaptation. First, continuity of place can be an important component in maintaining or reinforcing identity[29]. Discontinuing identity is associated with grief and strong social impacts related to loss[30,31]. Second, although migrating to new places to secure income can positively contribute to the

adaptation process through opening new economic opportunities, migration can also diminish the benefits by increasing financial and emotional stress and weakening social structures in both source and destination communities[22,32].

Culture affects adaptive pathways

Insights into the cultural dimensions of climate change challenge many of the fundamental assumptions that have guided research on climate change adaptation. Most attempts to integrate adaptation into models of climate change assume simple cause-and-effect relationships between environmental risks and social responses. Such responses seldom appear in practice. In fact, impact models generally fail to explain why different groups exposed to the same sets of changes display vastly different responses. For example, in Burkina Faso different groups of pastoralists have responded to recurrent drought in different ways, with the Fulbe struggling to find alternative income streams, whereas their former slaves—the Rimaiibe people—have diversified their livelihoods through more extensive use of labour migration[33]. Similar differentiation is demonstrated in fishing communities in India, where responses are bounded by cultural practices within different ethnic groups[34]. Historically, too, pre-modern cultures were able to adapt to environmental changes with varying degrees of success: for example, drought seems to have been a factor in the collapse of some civilizations, whereas others were able to persist[35].

Cultural perspectives help to explain differences in responses across populations to the same environmental risks. Recent research shows that information about climate change does not connect with all cultures and worldviews in the same way. Douglas and Wildavsky[2] argue that societies with shared values and beliefs produce their own selective view of the natural environment, which influences how they interpret and respond to risk. Climate change narratives often interact with other beliefs to motivate responses, which in some cases may not be consistent with the 'rational' responses advocated by institutions promoting adaptation[36]. For example, people in atoll islands in the South Pacific merge scientific information about climate change with pre-existing narratives about cultural decline in ways that discourage adaptation[37,38].

Although local knowledge and practices can be effective for progressively adapting to climate change, they may have limited utility when cultures are confronted with rapid or nonlinear changes. For example, although archaeological records suggest that the Pueblo Indian peoples were able to use a mix of strategies to adapt to drought, as drought became more prolonged and intense such

Box 1 | Culture and climate change in a small island state.

Niue is a Polynesian island with a population of 1,500. Climate change poses a considerable risk to aspects of Niuean culture that Niueans themselves value. The island is exposed to cyclones: Heta in 2004 caused damage to resources that sustain material culture, including to stocks of the moota (*Dysoxylum forsteri*) tree used to make the distinctive outrigger canoes, an important symbol of Niuean culture. Attempts to sustain Niuean culture have focused on canoe building and traditional fishing practices from these canoes. Cyclone Heta also damaged culturally significant artefacts, including the Niue national museum and the Huanaki cultural centre, which was the central venue to meet and take part in traditional dances, singing and narration of oral histories[88].

Niue has also suffered from significant population decline since 1971. Of all present Niueans born in Niue, about 5,500 live in New Zealand—more than three times the number of the current resident population. Niueans living in Niue therefore perceive themselves as trustees of Niue's 'Taoga'—their precious possessions, including its resources, customs and traditions, language, and arts and crafts. Niueans perceive their Taoga as how they interact with the land and sea, and with each other. For example, harvesting talo and fish ritualizes Niuean belonging to the land and seas: these foods are the material products of cultural practice. As climate change undermines yields of these resources it simultaneously undermines the sustainability of Niuean culture.

Finally, Niueans are well aware of climate change and the risks it is said to pose to their lives and livelihoods. Cyclone Heta was immediately understood as being a harbinger of things to come. Thus Niueans receive information about climate change and interpret it in terms of their existing concerns: cyclones and droughts, and population decline. Knowledge about climate has therefore subtly changed Niueans' confidence in the sustainability of their island and culture, making their island home seem less safe, and the future less secure[89].

Box 2 | Identity and attachment in migration and resettlement decisions in response to climate risks.

An emerging focus on migration as a rational response to climate change impacts[90] with evidence shows that:
(1) Migration is a beneficial strategy for spreading risk in sensitive economic sectors and regions;
(2) Migration is limited to those with threshold levels of economic resources and human capital, and hence immobility is an important dimension of the problem[91];
(3) Planned resettlement is likely in the future both in response to climate risks and also as a by-product of energy investments and land-use changes for mitigating climate change[92].

Identity is an important dimension of migration decisions, including in choice of destination for migrants, and in the adaptation strategies of migrants in these destination regions and countries.

Specific work on identity and migration to environmental risks finds:
(1) Those at risk almost always exhibit and state their desire not to relocate, expressed as being for cultural reasons[93];
(2) Those being resettled often resist attempts by authorities to move them;
(3) In some circumstances the effects of population decline on communities from which migrants move can undermine community cohesion, cultural continuity and adaptive capacity, although diaspora links are often critical mediating influences[15,94,95];
(4) Migrants themselves often move to areas at risk; loss of their localized environmental knowledge makes them more vulnerable to environmental risks in new localities[96].

Yet much of the evidence so far accumulated has underemphasized the role of place and identity in individuals' decisions to adapt in one place or relocate.

strategies became less effective, leading to famine, social conflicts and increased migration[39]. For the St'át'imc people in British Columbia, changes in the timing, abundance and quality of sockeye salmon are so great that despite traditional knowledge, there seems to be no effective adaptation to manage the effects of these changes on St'át'imc culture[40]. For the Inuit in Nunavut, changes in the ability to predict the weather have not only affected hunting and travel but have also had emotional, cultural and spiritual consequences[41].

Place attachment may also shape adaptive responses. For example, Mishra and colleagues[42] observe that people with high levels of place attachment were more likely to be motivated to prepare for climate change events such as flooding because of their social and economic investments within their region. Several other researchers have also suggested that attachment to place is more likely to result in pro-environmental behaviour[43–45]. These observations suggest that place attachment may inspire citizens to develop or participate in climate adaptation planning processes[46].

Culture also shapes values, and there is a considerable body of research in the social sciences and humanities that considers how values are related to culture, cognition and economic factors[47]. This body of knowledge is reflected in recent climate change research that examines the relationship between values and adaptation choices[48,49]. The emerging literature shows that differences in values may create tensions or discrepancies between adaptations that are deemed rational and effective by governments and planners, and those that are considered important to and desirable by individuals

and communities. In climate change adaptation, as in development more generally, culture and politics interact to determine who has voice, whose values count and what information is legitimate[50].

To understand adaptation as a social process requires increased attention to the meaning of climate change, including to the opportunities created, and the ways it can influence community and identity. Climate change can directly challenge traditional or established identities. Norgaard[51], for example, considers how the socially constructed national identity of Norwegians is increasingly in contradiction to political economic relations, leading to so-called implicatory denial of climate change (rejection of the psychological, political or moral implications of information). Climate change is often portrayed as a global-scale problem: it often does not resonate with the values associated with many traditional, ethnocentric worldviews, and may contribute to antagonism or cognitive dissonance. Yet in revealing linkages and connections that are not readily perceived or visible, climate change can also promote humanist values that counter exclusive and conformist values. Changes in individual and collective identities can open up possibilities for forming symbolic identities with distant others and 'elective' communities and facilitate new forms of collective action.

Where culture itself is able to change during times of flux—for example by developing new narratives, alternative meanings or strategies to lead meaningful lives—then it can serve as an important enabler of change. Indeed, culture is dynamic, and climate change may prompt beneficial as well as negative changes. In effect, current framing of cultural dimensions of climate change demonstrates apparently paradoxical insights. First there is considerable evidence that climate change poses risks and threats to values and

Table 2 | Examples of large-scale climate and other assessments and their attempts to incorporate cultural dimensions.

Assessments	Objectives	How they assessed cultural dimensions
Millennium Ecosystem Assessment (2005)[84]	Global and subregional assessment of changes in ecosystems and links to human wellbeing	Assessment of cultural services (chapter in the report) through review of published science and case studies; focus on knowledge systems, spiritual values, aesthetics and art.
Arctic Climate Impact Assessment (2005)[85]	Regional scientific assessment of climate change impacts	Observations of environmental and climate change by indigenous peoples documented using case studies based on existing projects (chapter in the report). Other scientific findings subjected to 'community review'.
National Ecosystem Assessment—United Kingdom (2011)[86]	National assessment of ecosystems and contributions to well-being	Chapter on assessment of cultural services using economic valuation, deliberative evaluation and applying Human Scale Development Matrix to link ecosystems and changes to subjective and objective well-being.
Climate Witness (on-going)[87]	Collating individual observations and experiences of change to publicize impacts and campaign for policies to address climate change	Structured interviews and posting of videos and photos on website used to build up an international database of stories of the meaning and experience of changing weather and resources.

cultural expressions that matter to individuals and communities, and that their capacity to adapt will be profoundly shaped by these risks. Second, there is increasing recognition that the idea of climate change, whether as a process or phenomenon, may itself be influencing cultural values, individual and collective identities and notions of community.

Implications for policy and science

These new insights into how culture interacts with climate-related risks could radically alter understanding of social responses to climate change, and affect how adaptation policies are designed. Most areas of public policy seek to promote societal goals through efficient policy mechanisms. Government action seeks to allocate resources efficiently to affect a desirable distribution in areas where autonomous actions and markets fail to do so. Given imperfect information on risks, much government action has been focused on reducing uncertainty, increasing information and protecting productive assets[52], for example by providing climate risk information and reducing risk through regulation and planning[53,54]. Yet as Douglas and Wildavsky note[2], responses based on assessments of physical risks and subjectively biased individual perceptions of risk are likely to fail without a cultural understanding of risk.

There is emerging evidence that current policies, at least for specific cases, partly by overlooking cultural dimensions, lead to maladaptive outcomes[27,55–57]. Protecting property through hard sea defences, for example, reduces public goods such as beaches. Similarly, transferring large amounts of water across river basins for economic reasons comes at the cost of place-specific cultural values of water and the integrity of small communities. Moving people to maintain their livelihoods comes at the cost of community cohesion and sense of place, and even switching to new agricultural practices to sustain production comes at the cost of the cultural values of food and its production.

Adaptation strategies can thus potentially undermine the resilience of communities and cultures, particularly when they promote private interests at the expense of public goods such as cultural heritage or community cohesion[58]. Adger and colleagues[59] reviewed a range of responses to climate change and showed how some damage resilience. This was related to a narrow framing of the problem and lack of consideration of interaction between climate change and other stressors; the institutions involved in responses; and a failure to recognize dynamic feedbacks.

Cultural factors shape how people support adaptation interventions, and their motivation to respond to them. The attachment that people have to their community may be an important predictor of how they might adapt and support strategies designed at higher levels. For example, people who value the stability associated with remaining in the one community[22,60] may experience deterioration in quality of life if they are forced to relocate as an adaptation to climate impacts[22]. Consequently, adaptation strategies that directly affect attachment to place may not be supported, and different strategies that allow people to remain in their current place are more likely to be successful. However, people who remain within their chosen place regardless of the tenability of the location are likely also to become 'losers' in the adaptation process.

Sometimes, of course, societies do invest in policies to support actions for powerful cultural reasons. An example is drought policy in Australia, where it has long been the case that government subsidies to farms have implicitly sought to sustain rural communities[61], but were arguably maladaptive given climatic changes increased the incidence of drought. Hurlimann and Dolnicar demonstrate that such policies were popular in the recipient communities and any policy change to promote adaptation through relocation and migration would be resisted by populations surveyed across Australian farming settlements[62].

So how could policy incorporate culture more explicitly? This would first require recognizing the explanatory power and the limitations of the methods of inquiry into culture. Ethnography is a primary method of cultural inquiry based on the immersion of the researcher in places. Cultural inquiry is also undertaken collaboratively with multiple stakeholders to understand how global processes (from emerging carbon markets to heat waves in cities) are articulated in local contexts[63]. These methods focus on issues such as perceptions of change; valuation and meaning of change; knowledge of climate, weather and risks; and documented responses in behaviour and practice[64,65]. Other methods of participant observation, narrative and historical analyses provide rich, context-specific qualitative data. Mental models approaches, such as companion modelling or agent-based modelling, explore knowledge systems and often aim to integrate traditional and scientific perspectives on change or to specifically support the design of adaptive management strategies.

Even armed with robust knowledge of cultural change, however, there is no simple blueprint for such action, as it is difficult in practice to incorporate multiple and marginalized voices and plural values into robust and replicable decision-making. Much of the vigorous promotion of community-based adaptation suggests that local-scale decision-making is more likely to promote plural and

cultural values and that it incorporates culture by building on local social norms and effecting change from within[66]. But community-based adaptation faces the challenges that some cultural expression "may be deeply and narrowly defined and thereby resistant to change"[67].

Good practice in public participation in adaptation decision-making usually includes notions of proportionality, inclusiveness and transparency[68]. Yet dealing with the cultural dimensions of climate change impacts is about more than an "illusion of inclusion"[69], given that community-led processes are constrained by the same focus on material assets and interests as politics at other scales. Nicholson-Cole and colleagues have shown, consistent with findings across the United Kingdom and elsewhere[70,71], that the perception of loss of control and lack of inclusion in the process of decision-making are the greatest barriers to legitimate incorporation of plural values. Rather, incorporating cultural dimensions requires recognizing diverse perspectives and promoting decision-making at appropriate and often multiple, scales.

Cultural dimensions highlighted here are rarely and only partially included in conventional assessments of climate change impacts and adaptation. Participatory monitoring of change and 'citizen science' approaches use lay knowledge and observations to gather data[72,73], but are limited in the extent to which they incorporate cultural perspectives and values. The IPCC assessments, for example, restrict themselves to peer-reviewed science. Table 2 shows how various international assessments attempt to include cultural factors: different methods used at different scales, ranging from primarily reliance on published science papers, perhaps subject to community review (in the Arctic Climate Impact Assessment), to attempts to encompass more plural cultural values (in the National Ecosystem Assessment), to more open narrative 'story-telling' approaches to documenting multi-faceted change (Climate Witness). Thus these initiatives seek to provide new platforms and new ways to engage with cultural dimensions of environmental change.

Conclusions

We highlight here the frontiers of research on culture and climate change including the potential threats to cultural assets and the role of culture in adaptation. Culture and identity are difficult to incorporate into public policy: losses of public goods such as community and place are not easily compensated or swayed by arguments over economically rational adjustments to risk. Acknowledging the importance of cultural factors is, however, an important first step. The challenge remains to address cultural dimensions, perhaps through appropriate-scale individual and community involvement in determining the goals of adaptation policies and shaping their means of implementation. This will be painstaking work; the scales of analysis and engagement will be smaller, with multiple policy communities, pathways and negotiations. Yet if the cultural dimensions of climate change are ignored, it is likely that both adaptation and mitigation responses will fail to be effective because they simply do not connect with what matters to individuals and communities.

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Acknowledgements

Author contributions

W.N.A. and K.B. formulated and planned the paper. All authors undertook the analysis and interpretation and wrote the paper.

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